ASSISTIVE CAMERA CONTROL

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ADVISOR: DR. GREEN

CLIENTS: MARK COPPIN AND SADY PAULSON

INTRODUCTION

- Our project is an assistive camera device
- Designed to help a person to easily control the zoom on a telephoto lens.
- Also will allow control for pan and tilt
- Will be controlled by a Java application using an on screen scanning system on a computer

INFORMATION ABOUT CLIENT

- Sady is a cinematography student who is nearing the completion of her undergraduate studies at Full Sail University
- She has cerebral palsy which makes it difficult for her to perform basic tasks with her camera such as pan tilt and zoom.
- She uses numerous technologies to help her use a computer.

REQUIREMENTS

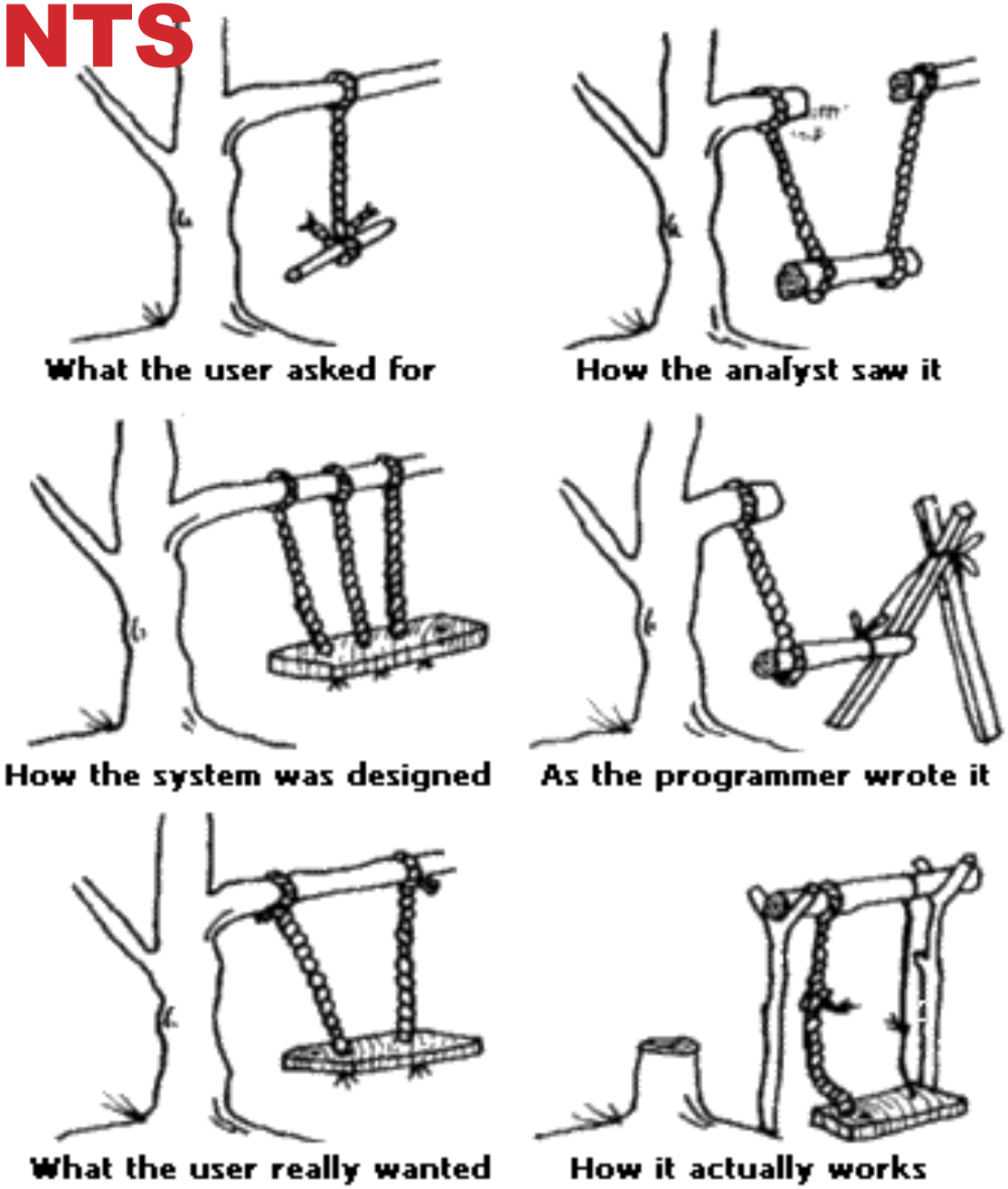
Zoom drive system

- Able to turn lens clockwise and counterclockwise
- Able to fully zoom in and out with a quarter turn of the lens
- Variable speed
- Controlled through the client's MacBook Pro
- Must fit 70.5 x 74mm lens

REQUIREMENTS

Pan/Tilt drive system

- Pan at least +/- 45 degrees from center position
- Variable speed
- Controlled through the client's MacBook Pro



REQUIREMENTS

Software

- Able to control zoom
- Able to support pan and tilt
- Able to support variable speed capabilities
- Able to create programed sequences for camera to follow

Power

- Devices will be powered from the client's on board battery
- Devices will have fault and overload protection

CAMERA PAN/TILT SERVOS

HS-7954

- 486 in-oz.
- Titanium gear set
- Digitally controlled
- Programmable

HS-5685MH

- 179 in-oz.
- Digitally controlled
- Programmable

LL

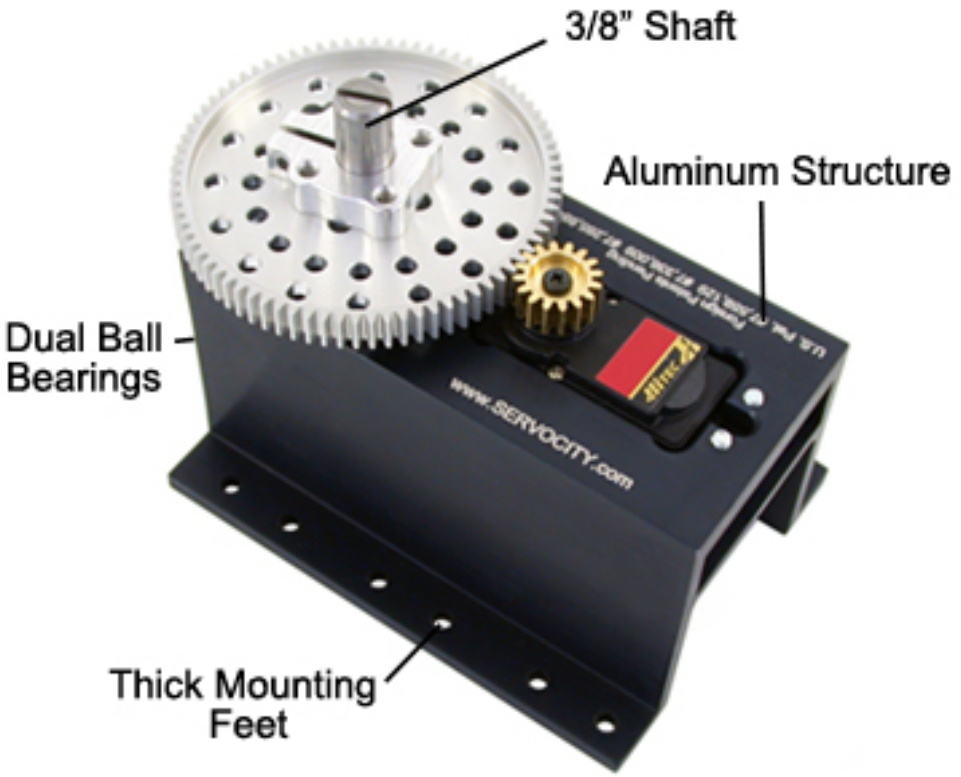
SERVO POWER SUPPLY

CC BEC PRO

- Programmable output voltage 4.8-12.5V
- 8-36V input
- 20A peak output

LL

CAMERA PAN UNIT



SPG400A-BM

- Potentiometer feedback
- 895 in-oz.
- 180 degree rotation
- Sturdy aluminum structure

LL

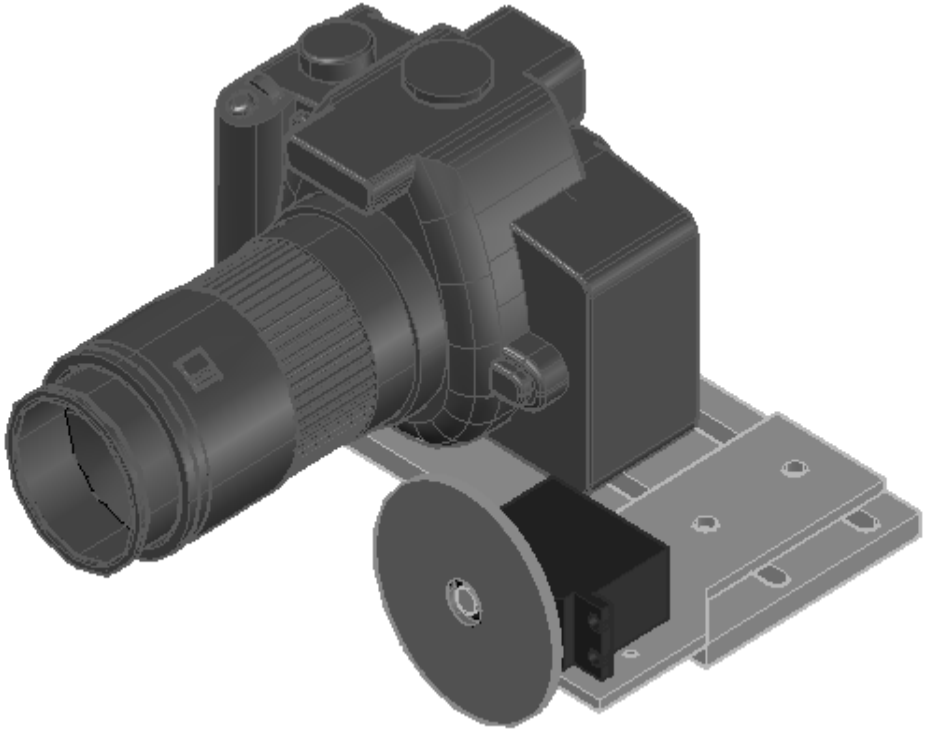
TILT UNIT

SPT400

- 6 lb. maximum payload
- Potentiometer feedback
- Fast
- Mounts directly to pan system

ZOOM UNIT

- Adjustable for multiple camera sizes
- Designed in AutoCAD
- Machined by NDSU IME department



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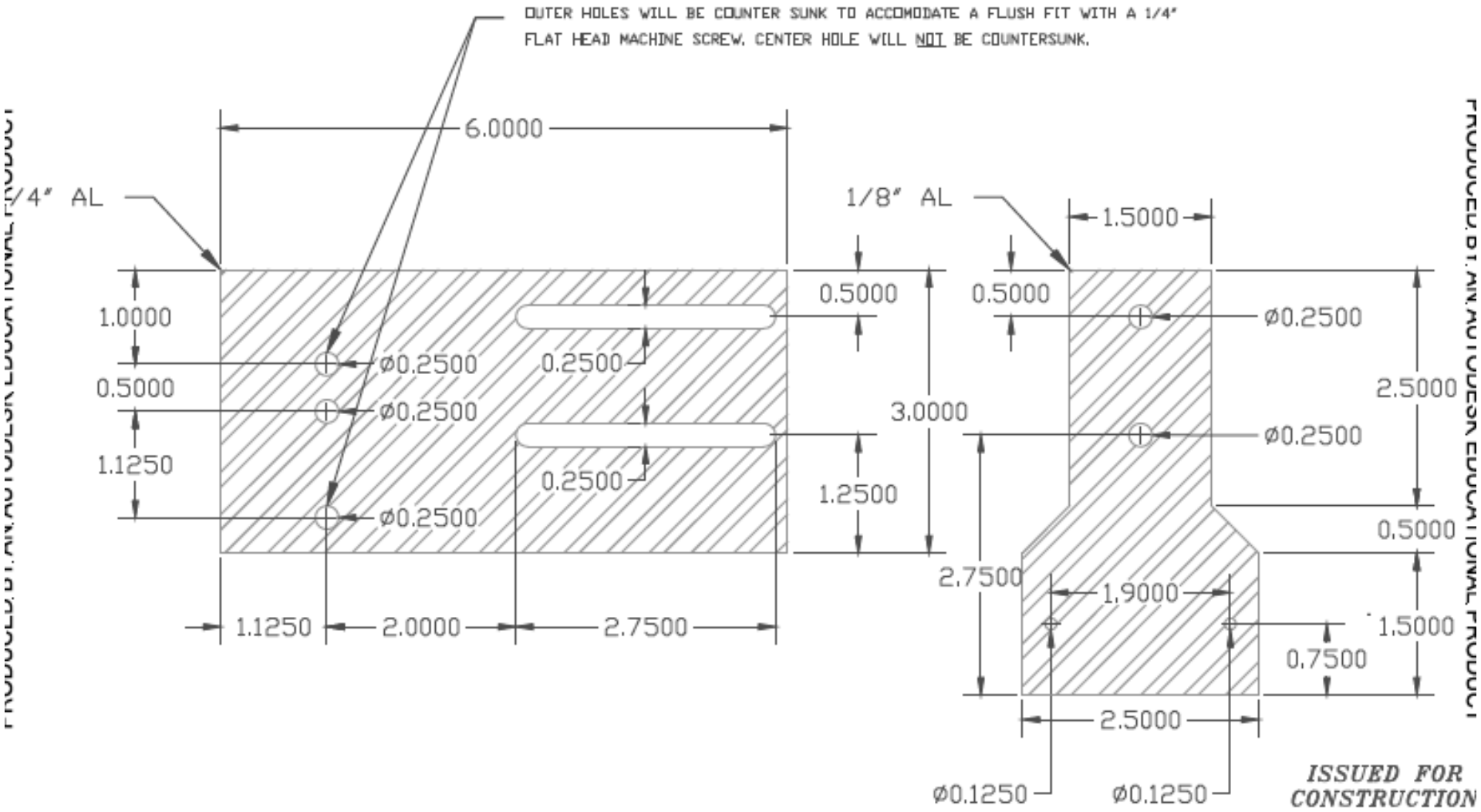
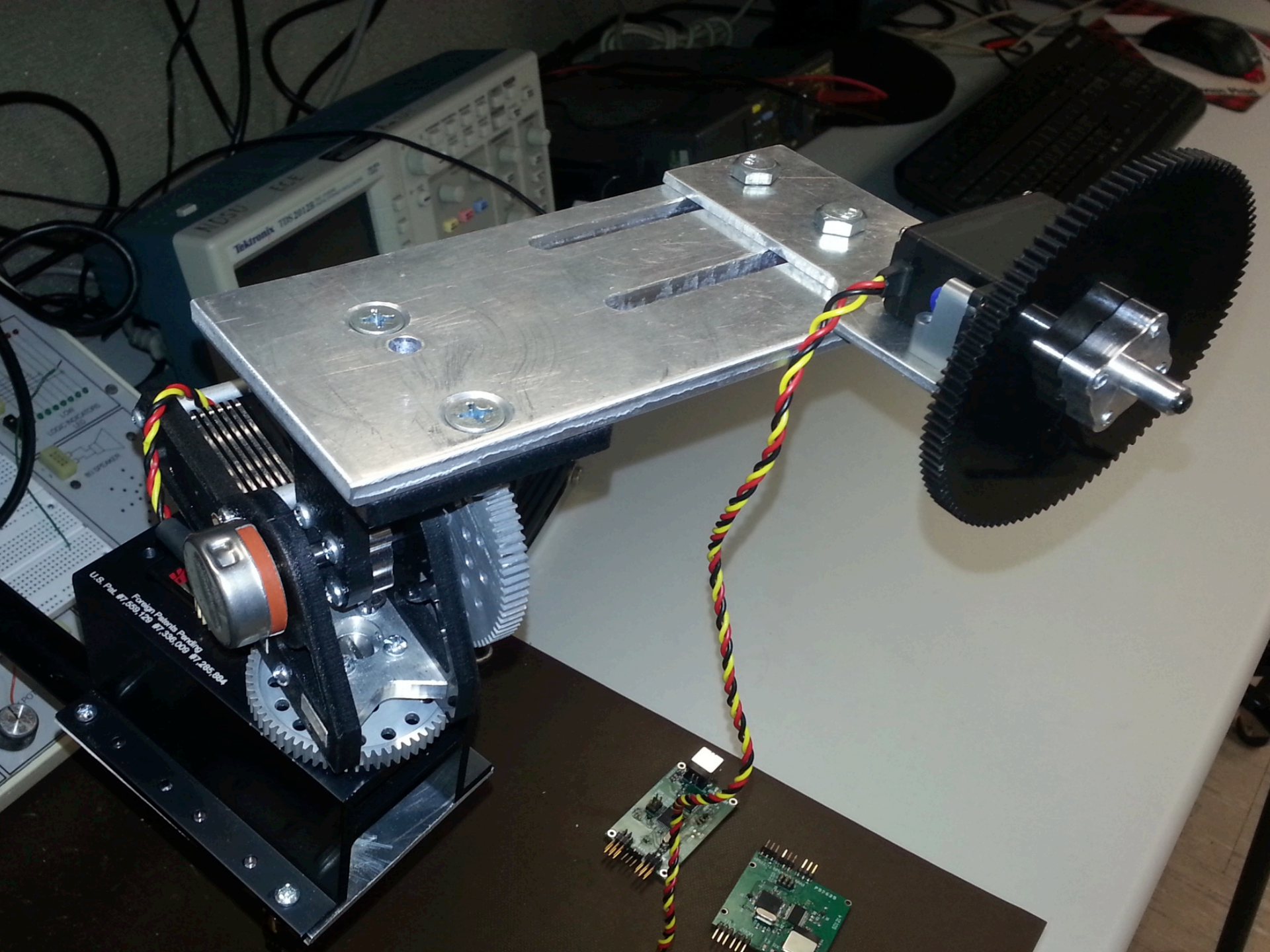
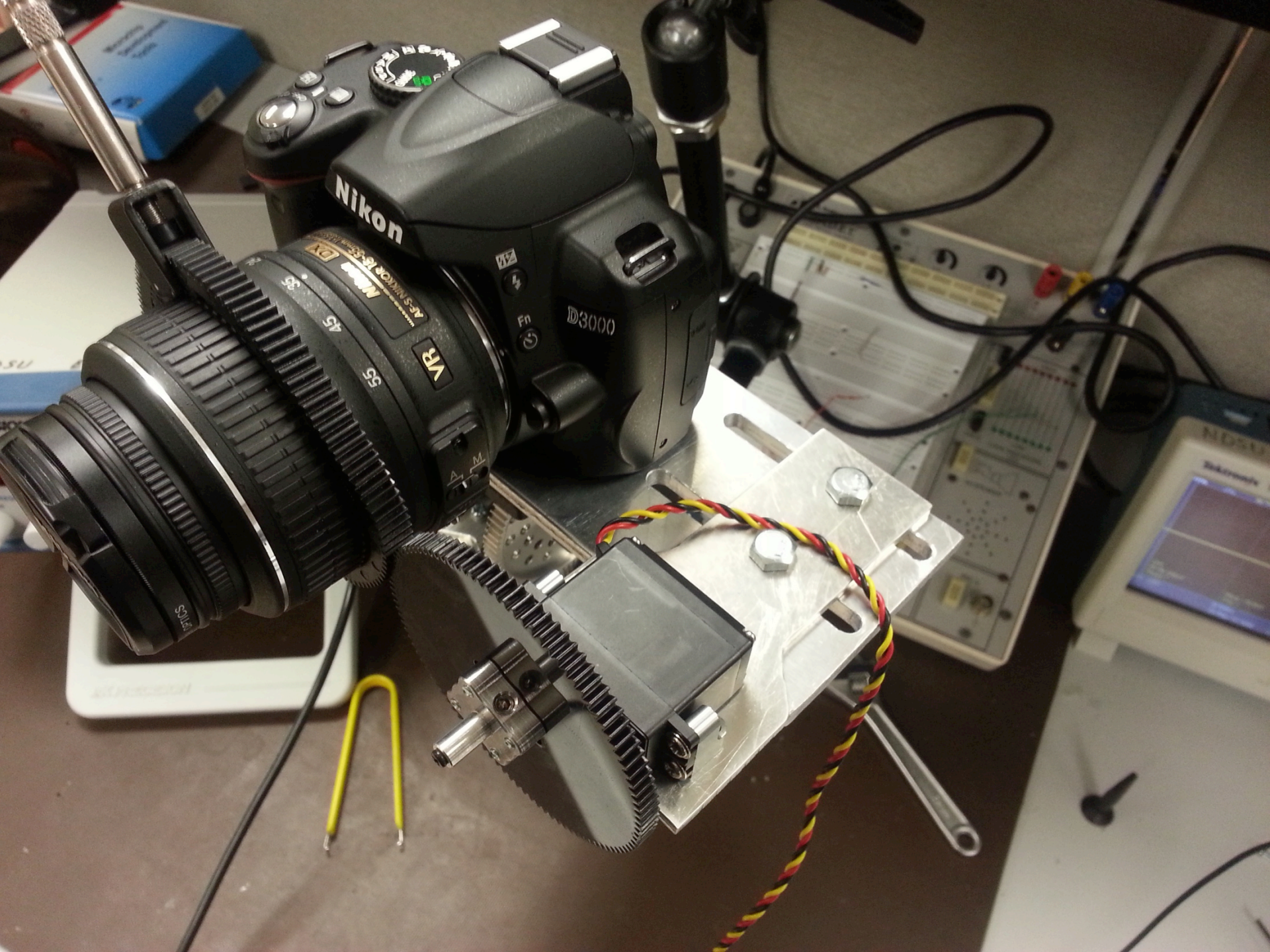


ISSUED FOR CONSTRUCTION

PRODUCED BY AN AUTODESK EDUCATIONAL PRODUCT

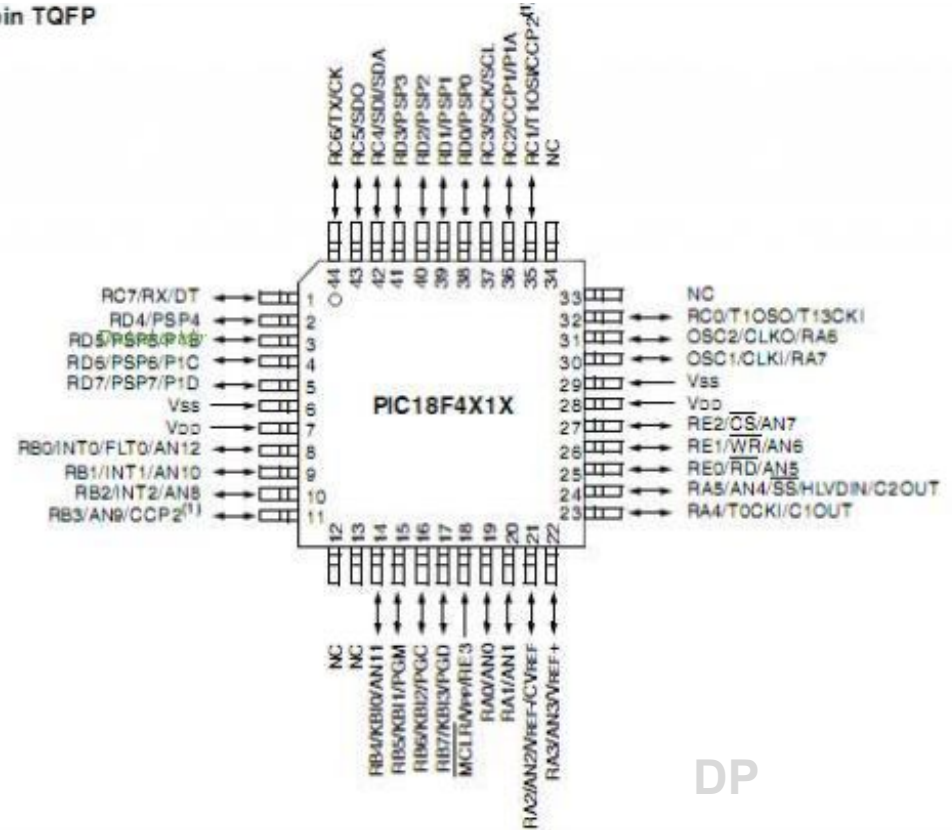

Tektronix
Foreign Patents Pending
U.S. Pat. #7,559,120 #7,380,009 #7,285,884


Nikon
D3000
VR
AF-S NIKKOR 18-55mm
55
45
35
A
M

MICROCONTROLLER

PIC 18F4620

- 64KB program memory
- 3968 Bytes of RAM
- 33 I/O lines
- TQFP Package



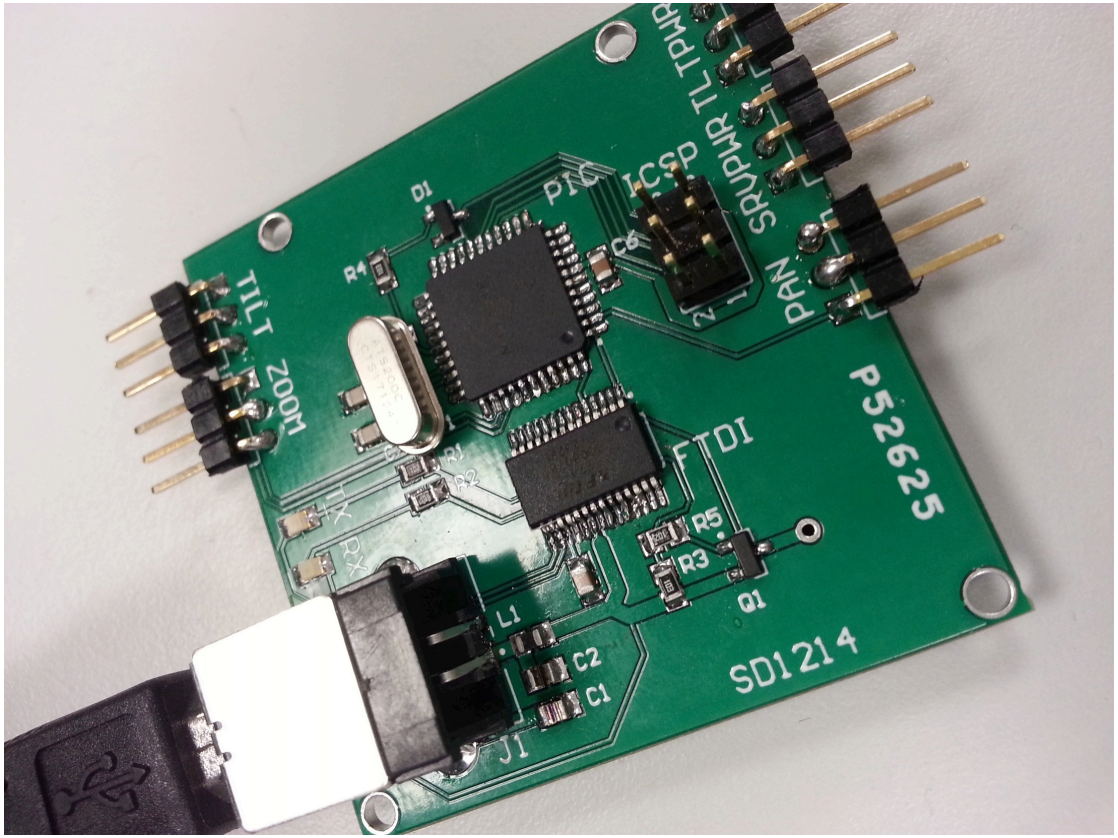
MICROCONTROLLER

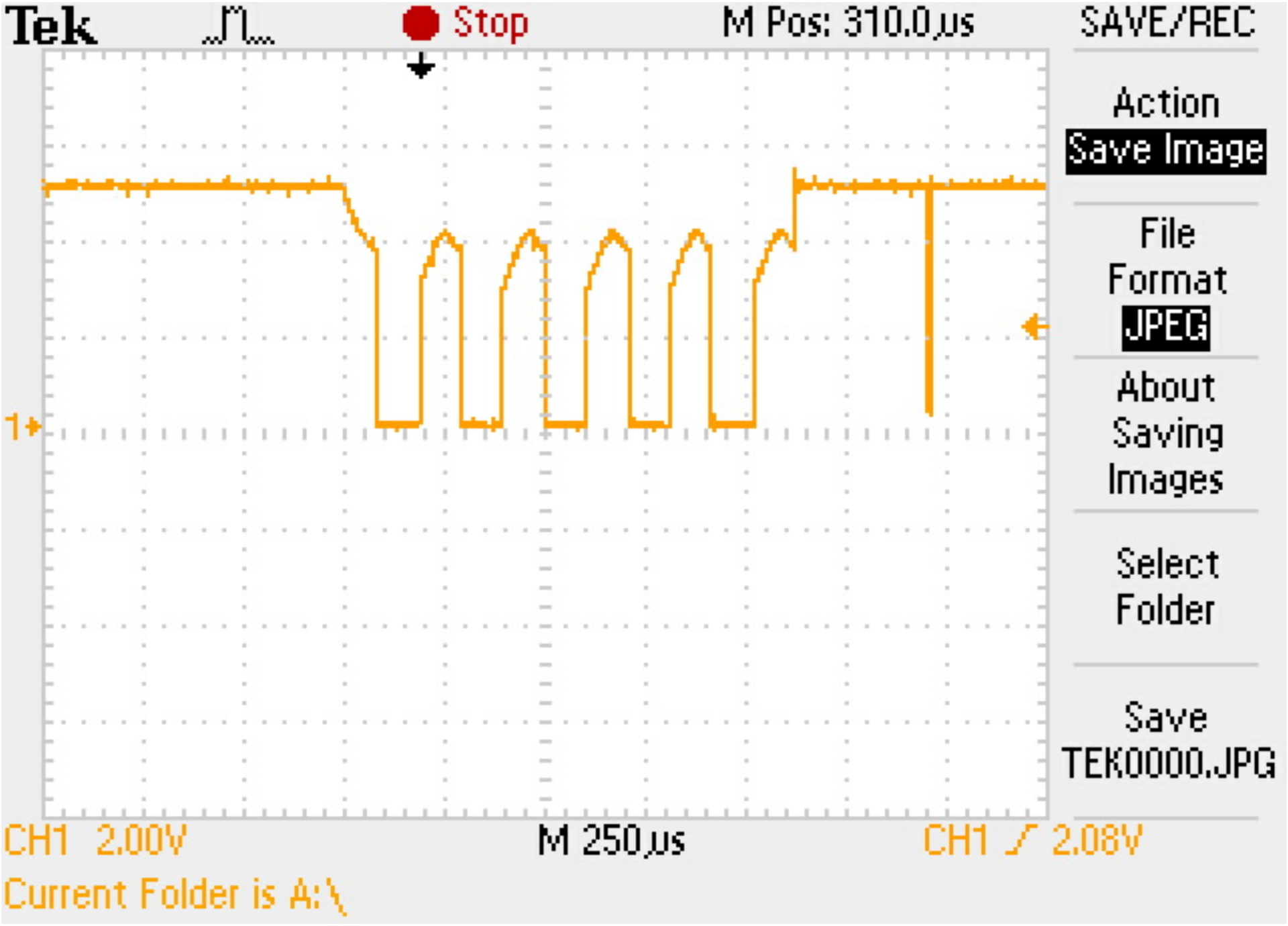
The microcontroller board must:

- **Interface with the computer software over USB**
- **Control the servo motors positions based on commands**
- **Be small enough to fit into the pan unit**

CONTROLLER REV 1

- **Faulty FTDI chip**
- **Replacing chip caused pads to lift resulting in a need for a REV 2**

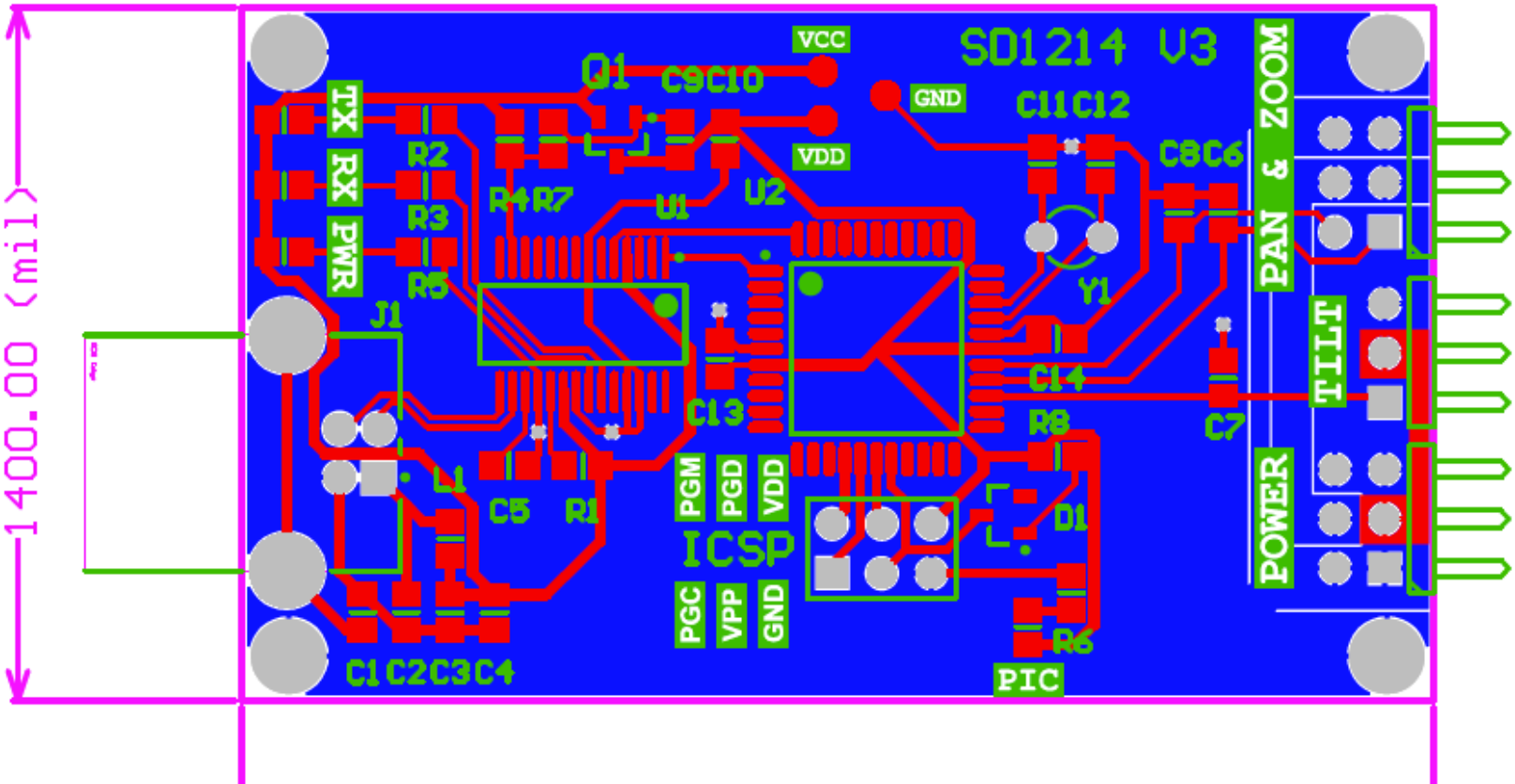


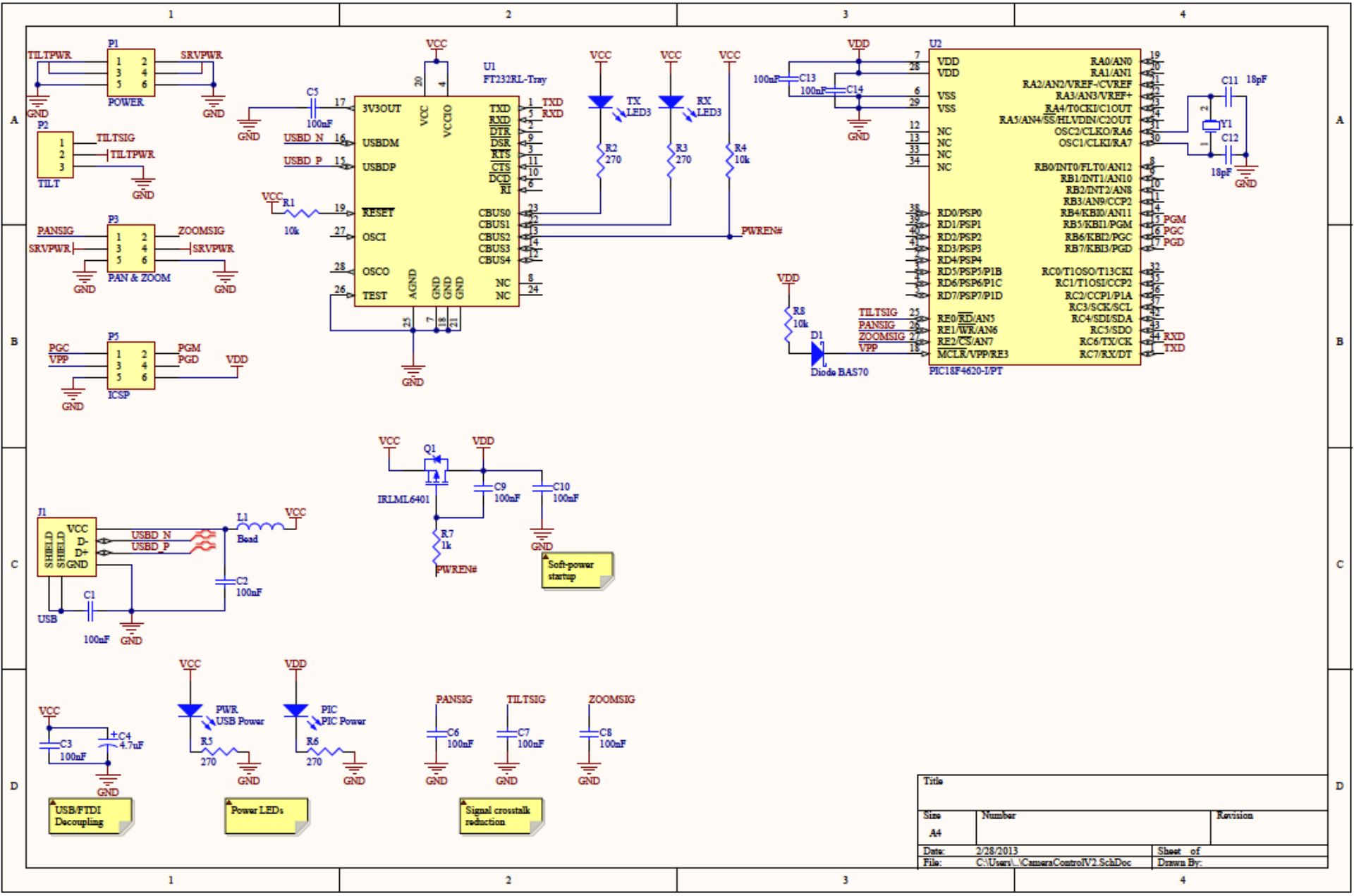

Tek
Stop
M Pos: 310.0µs
SAVE/REC
Action
Save Image
File
Format
JPEG
About
Saving
Images
Select
Folder
Save
TEK0000.JPG
1
CH1 2.00V
M 250µs
CH1 ∫ 2.08V
Current Folder is A:\

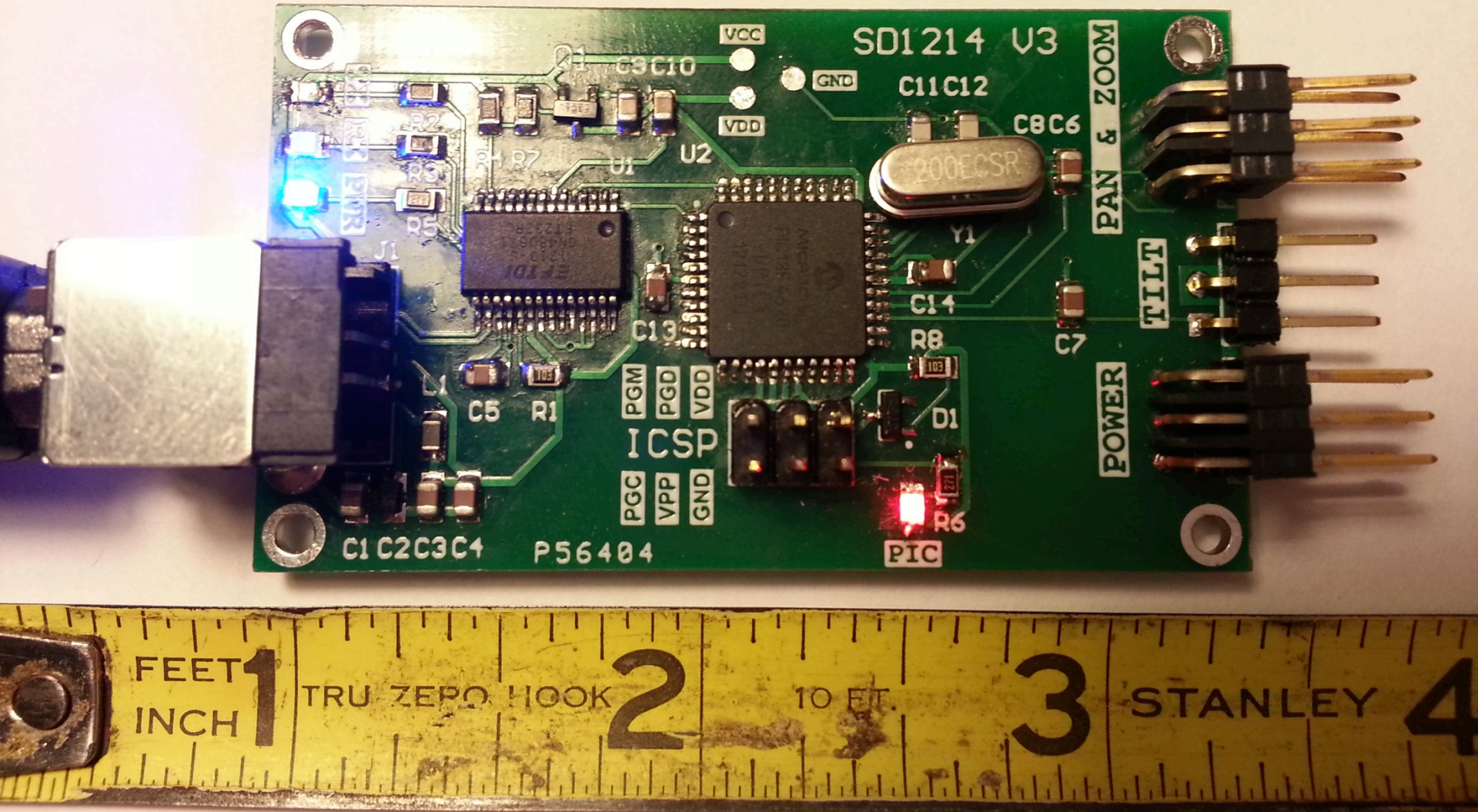
CONTROLLER REV 2

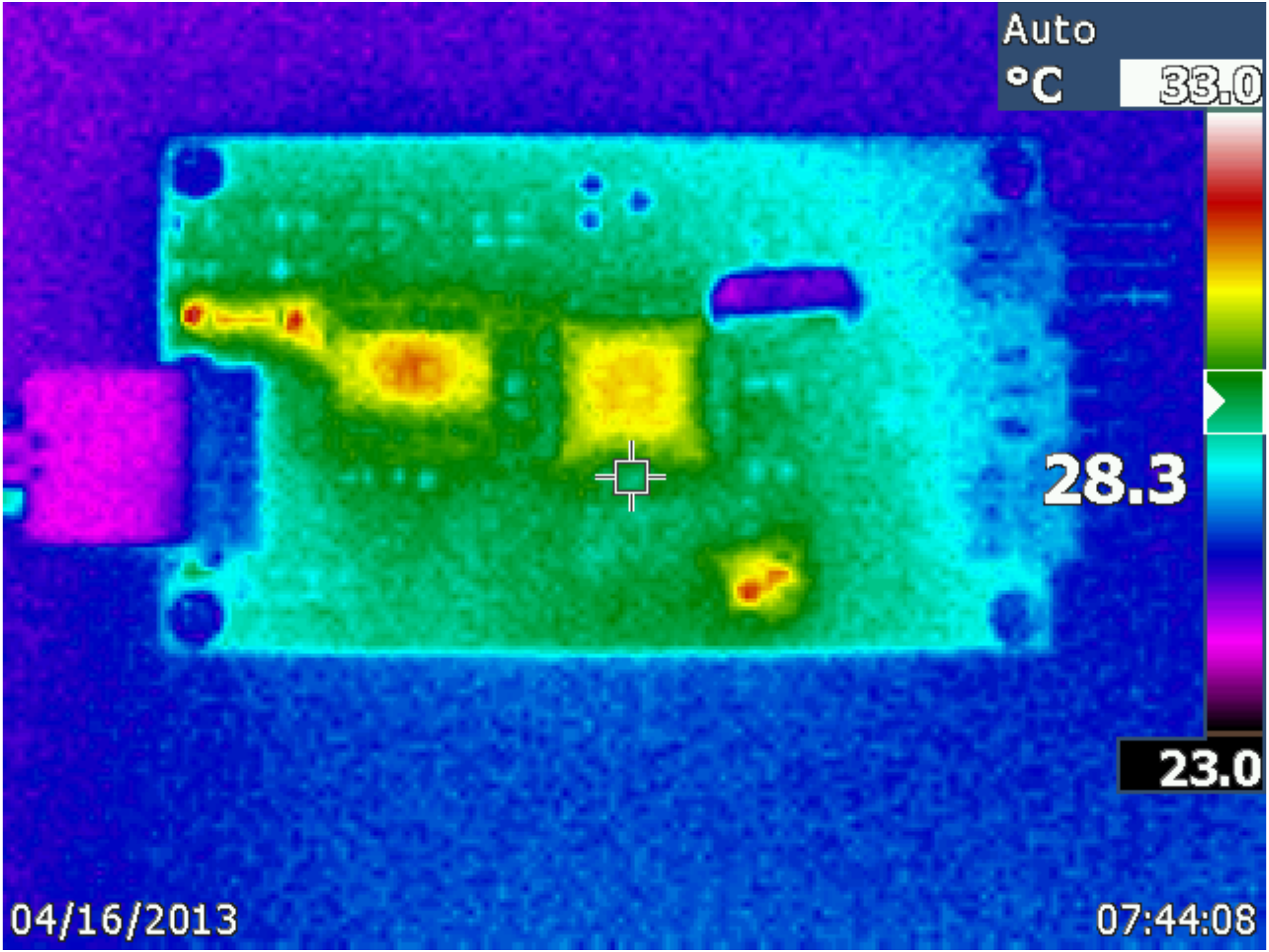
Changes in REV 2

- **Added power LEDS**
- **Added capacitors on servo signal traces**
- **Adjusted size to fit under the pan unit**

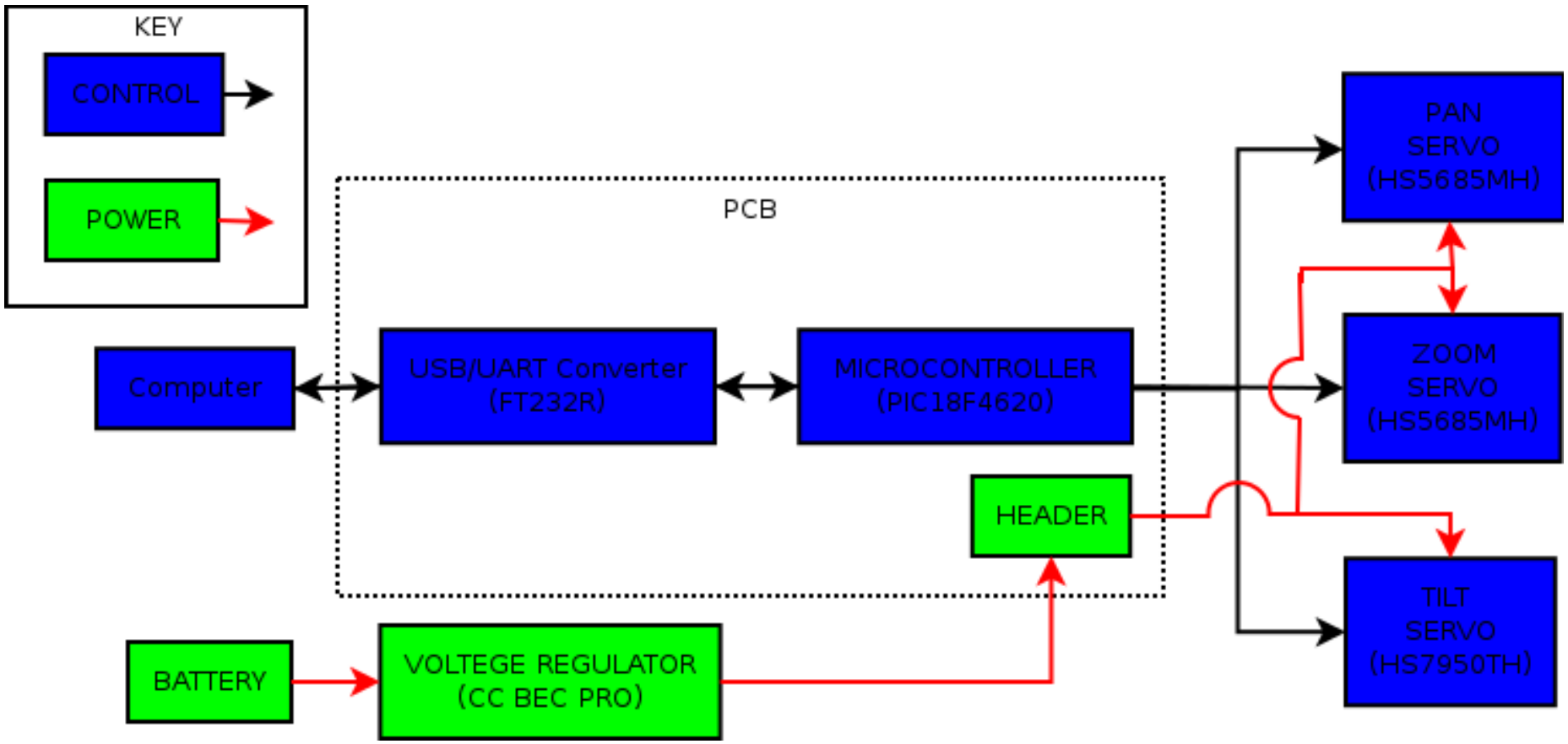



P1
TILTPWR
SRVPWR
POWER
GND
P2
TILTSIG
TILTPWR
TILT
P3
PANSIG
ZOOMSIG
SRVPWR
PAN & ZOOM
P5
PGC
VPP
PGM
PGD
VDD
ICSP
U1
FT232RL-Tray
3V3OUT
USBDM
USBDP
RESET
OSCI
OSCO
TEST
TXD
RXD
DTR
DSR
RTS
CTS
DCD
RI
CBUS0
CBUS1
CBUS2
CBUS3
CBUS4
NC
AGND
VCC
VCCIO
C5
100nF
R1
10k
USBD_N
USBD_P
TX
LED3
RX
LED3
R2
270
R3
270
R4
10k
PWREN#
U2
PIC18F4620-I/PT
C13
100nF
C14
100nF
C11
18pF
C12
18pF
Y1
R8
10k
D1
Diode BAS70
TILTSIG
PANSIG
ZOOMSIG
VPP
PGM
PGC
PGD
RXD
TXD
J1
USB
L1
Bead
C1
100nF
C2
100nF
Q1
IRLML6401
C9
100nF
C10
100nF
R7
1k
Soft-power startup
C3
100nF
C4
4.7uF
USB/FTDI Decoupling
PWR
USB Power
PIC
PIC Power
R5
270
R6
270
Power LEDs
C6
100nF
C7
100nF
C8
100nF
Signal crosstalk reduction
Title
Size
A4
Number
Revision
Date:
2/28/2013
Sheet of
File:
C:\Users\...\CameraControlV2.SchDoc
Drawn By:

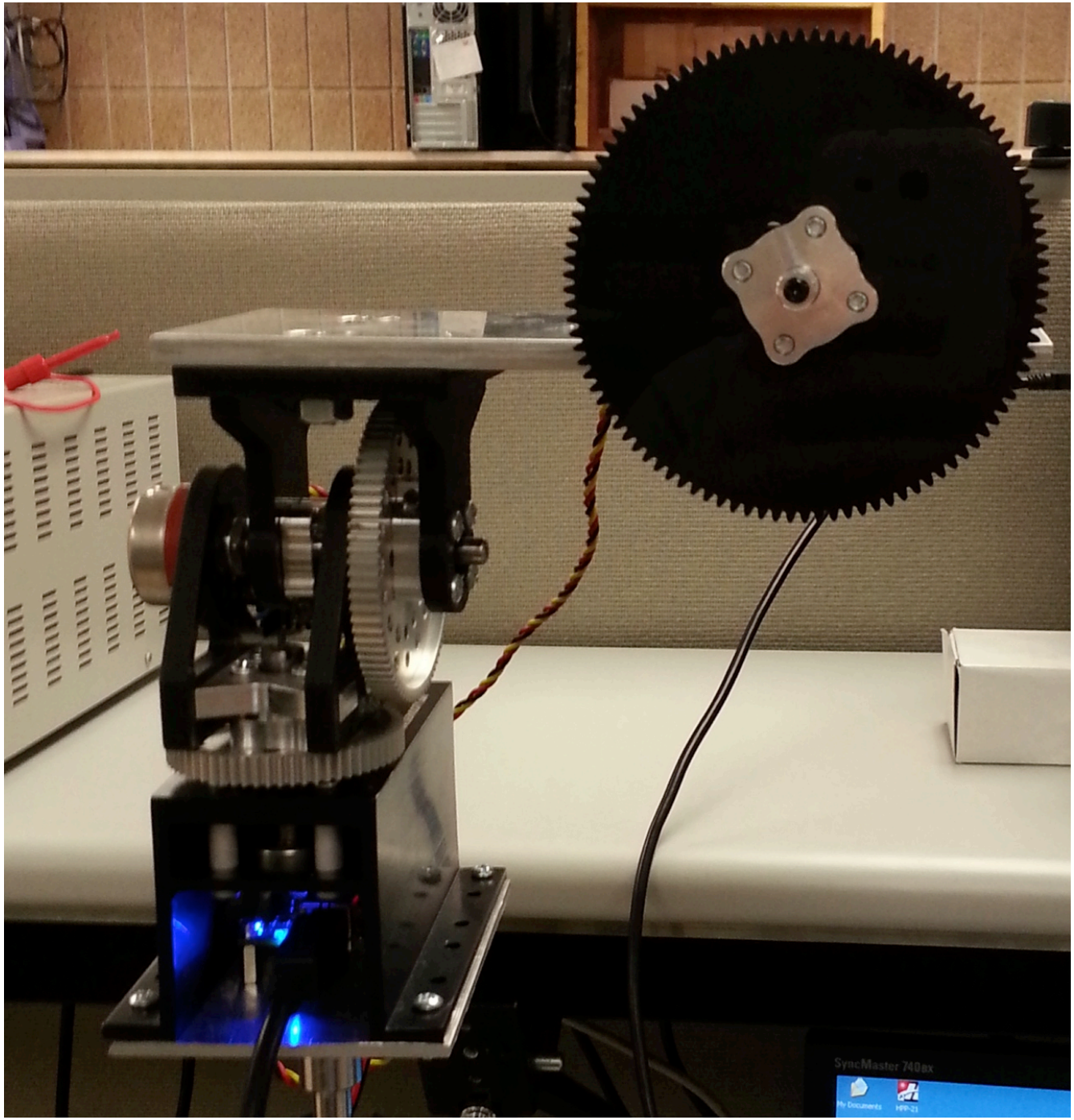

SD1214 V3
VCC
VDD
GND
C9C10
C11C12
C8C6
U1
U2
R2
R3
R5
R7
J1
Y1
C14
C13
C7
R8
L1
C5
R1
PGM
PGD
VDD
ICSP
PGC
VPP
GND
D1
R6
PIC
C1C2C3C4
P56404
PAN & ZOOM
TILT
POWER
FEET
INCH
TRU ZEPO HOOK
10 FT.
STANLEY


Auto
°C
33.0
28.3
23.0
04/16/2013
07:44:08

HARDWARE BLOCK DIAGRAM



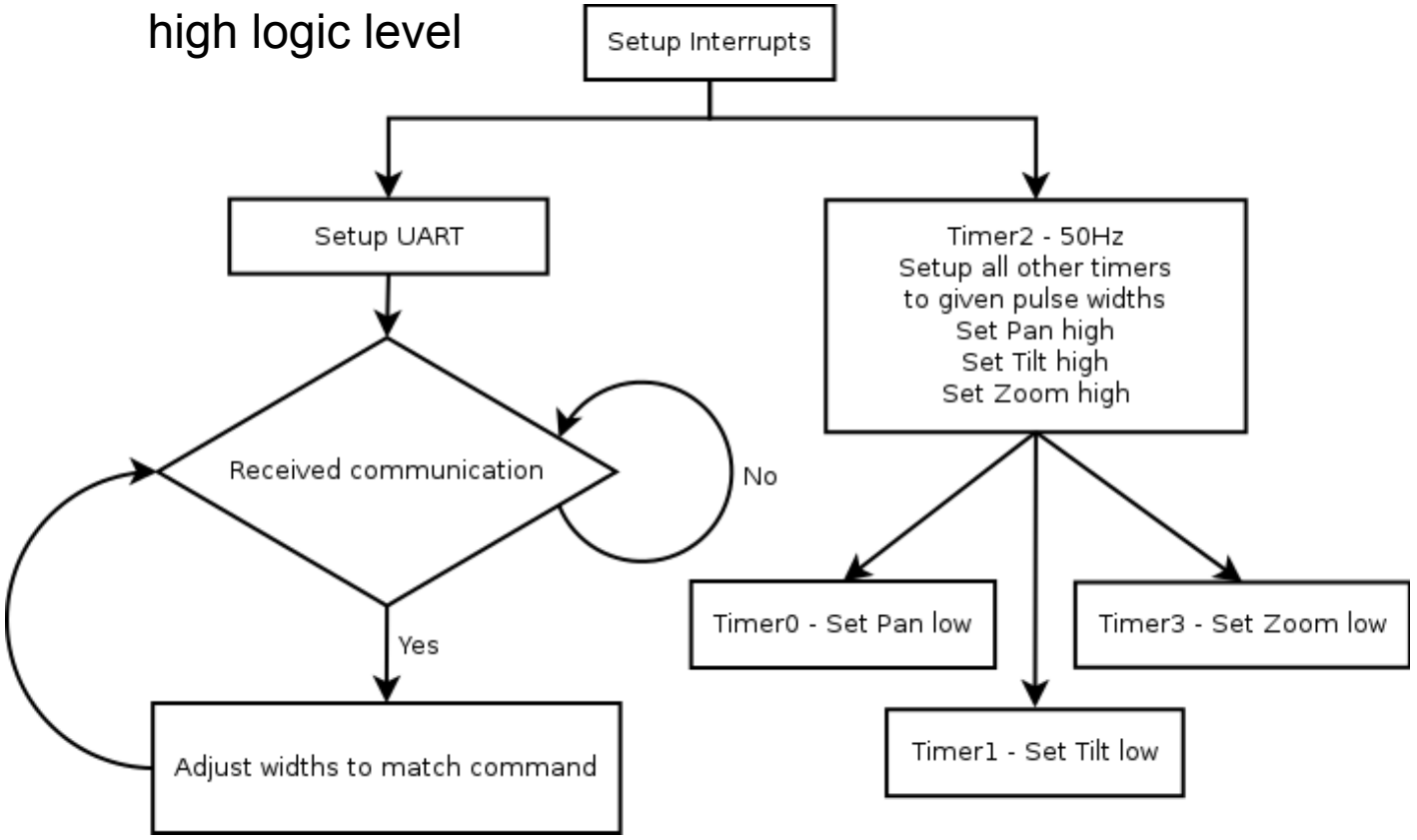
DP


SyncMaster 740BX

PIC SOFTWARE

PIC Side:

- Generates 3 pulse-widths simultaneously communicating with computer
- Two separate processing threads at once
  - First thread handles communication with the computer
  - Second thread uses all 4 of the timers on the PIC
    - 8-bit timer setup to get a 50Hz refresh update that then sets
    - 3 16-bit timers durations up and raises all the pulse-width pins to a high logic level



SG

PROTOCOL

C = Center

P0900 = Pan 900uS

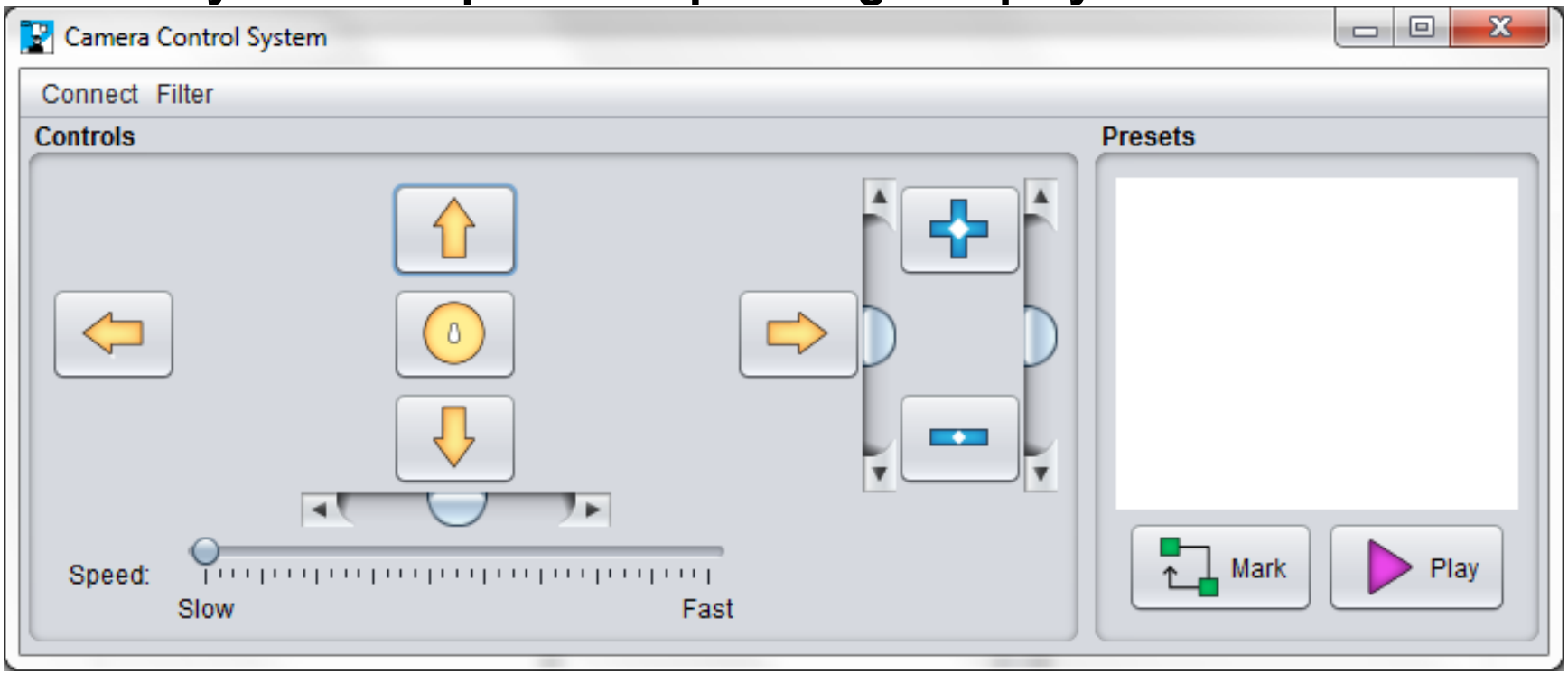
T0900 = Tilt 900uS

Z0900 = Zoom 900uS

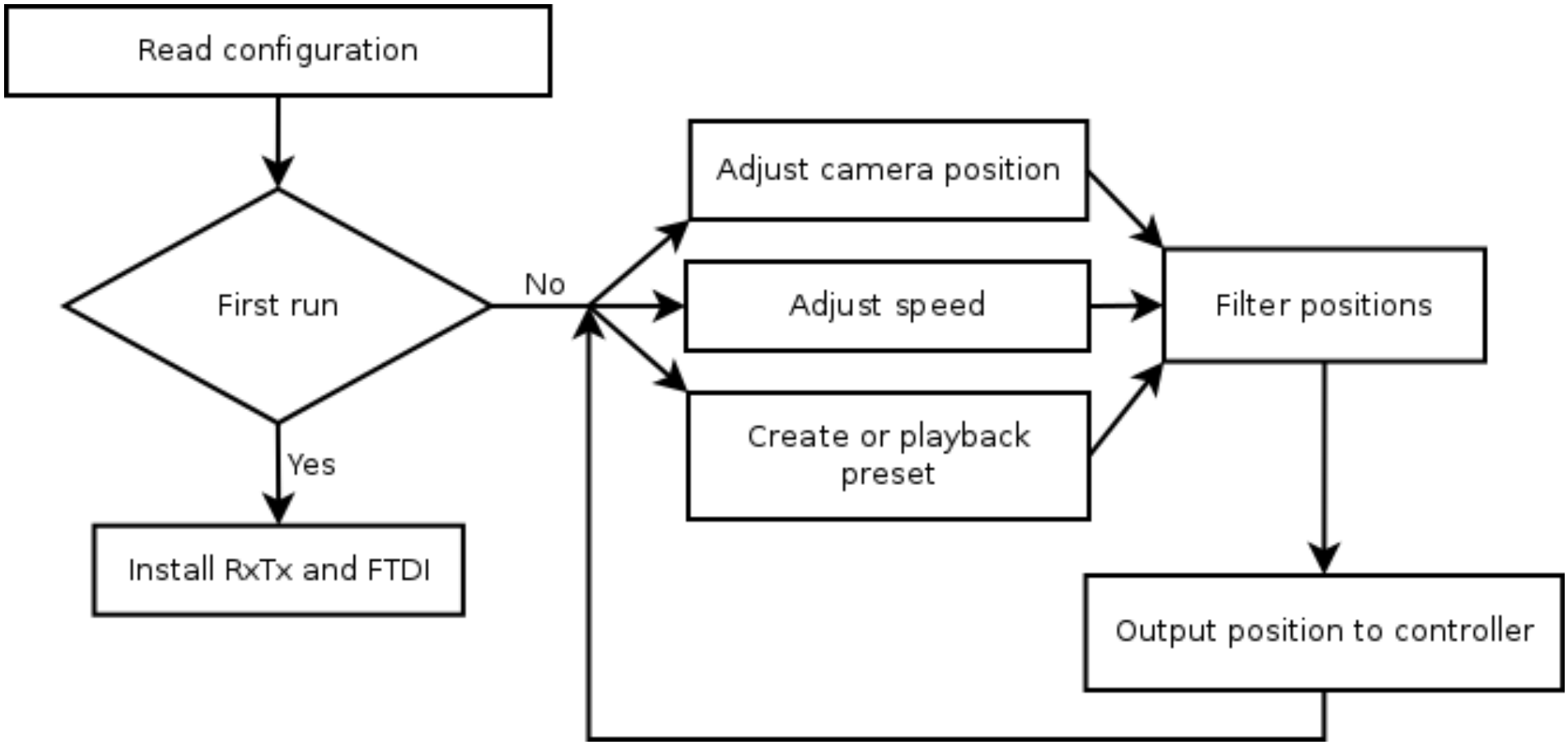
Range: 900-2100uS

APP SOFTWARE

- Sends commands to the PIC over USB to change the servomotor angles
- Controlled by hotkeys
- Adjustable filter
- Ability to create preset sequencing and playback



SG


Read configuration
First run
Yes
Install RxTx and FTDI
No
Adjust camera position
Adjust speed
Create or playback preset
Filter positions
Output position to controller

TESTING AND EVALUATION

- Tested with client present
- All functions work
- Meets every requirement

PROBLEMS ENCOUNTERED

- First controller board didn’t work
- Servos were noisy
- PIC losing its program
- Mac driver is terrible

Item ID	Description	Vendor	Cost	Qty.	Total Cost
A31725-ND	USB-B Socket	DigiKey	$1.92	2	$3.84
Various	0805 Resistors 270, 1k, 10k	DigiKey	$0.01	30	$0.30
Various	0805 Capacitors 100nF	DigiKey	$0.01	20	$0.20
IRLML6401PBFCT-ND	IRLML6401 SOT23	DigiKey	$0.53	2	$1.06
PIC18F4620-I/PT-ND	PIC18F4620 TQFP-44	DigiKey	$7.80	2	$15.60
768-1007-1-ND	FTDI 232RL SSOP	DigiKey	$4.50	2	$9.00
BAS70-00-V-GS08CT-ND	BAS70 Diode	DigiKey	$0.45	2	$0.90
PCB Manufacture		Advanced Circuits	$50.00	2	$100.00
SPT400	Tilt System	Servo City	$219.98	1	$219.98
SPG5685A-BM	Pan System	Servo City	$129.98	1	$129.98
HS-5685MH	High torque servo	Servo City	$39.99	3	$119.97
HP-21+	Servo Programmer	Castle Creations	$49.99	1	$49.99
voltage regulator	010-004-01	Castle Creations	$44.95	1	$44.95
Pulley	10T-6MM-PL	Servo City	$16.99	1	$16.99
15" Belt	B375-150XL	Servo City	$8.99	1	$8.99
Hub Gear	MG64T-32P-250F-50B	Servo City	$12.99	1	$12.99
Drive gear	RSA32-HMG-32	Servo City	$14.99	1	$14.99
USB Programmer	010-0005-00	Servo City	$25.00	1	$25.00
Machining		NDSU IME	$130.00	1	$130.00
Total:					**$904.73**

FUTURE WORK

- Improved control board with more powerful microcontroller
- Add features to software

SUMMARY

We designed a system that would allow Sady to easily control all aspects of her camera by herself. The system functions as desired. We would consider this to be a successful project.

THE END